

**Results of the Field
Reconnaissance Survey of
the Ringwood
Mines/Landfill Site,
Ringwood, New Jersey**

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1. Introduction and Executive Summary

ARCADIS G&M, Inc. (ARCADIS), on behalf of the Ford Motor Company (Ford), has completed a Field Reconnaissance Survey of the Ringwood Mines/Landfill Site (Site) as the first module of a Comprehensive Investigation Work Plan (CIWP) developed for the Site. The CIWP was prepared in cooperation with United States Environmental Protection Agency (EPA) in response to concerns regarding the presence of potential Ford-generated wastes at the Site including, in particular, paint sludge and drums or drum remnants.¹ The Module 1 Work Plan was approved by the EPA on December 2, 2004. Other CIWP work plan modules have been prepared and submitted to the USEPA under separate cover, and they are included by reference within this report.

The Field Reconnaissance Survey implemented a screening process designed to identify, and then visually search, non-residential areas of the Site that potentially could have received Ford-generated wastes. The primary objectives of the Field Reconnaissance Survey included:

- Identify: (1) areas of the Site that may have been filled during, or proximate, to the period of Site ownership by Ford's former subsidiary, Ringwood Realty Corporation (Ringwood Realty); and (2) locations where the presence of vehicle-accessible roads during Ford's ownership period and Site topographic features indicate that disposal activities could have occurred due to their potential accessibility;
- Undertake a systematic, walking survey of all areas identified by the methods described above, looking for paint sludge and/or drum remnants, using surface condition observations and shallow soil push cores. All survey points were located with a global positioning system (GPS) to allow location-based descriptions of observed conditions. At the direction of the EPA, residential properties were excluded from this Survey. The EPA intends to survey the residential properties pursuant to a separate EPA-prepared work plan.

¹ There have been disposal activities by others at the Site. The Module 1 Work Plan addresses potential Ford-generated wastes and was approved by the EPA on November 23, 2004. Other CIWP work plan modules have been prepared and submitted to the USEPA under separate cover, and they are included by reference within this report.

Key findings of the Reconnaissance Survey include:

- The Survey confirmed that paint sludge and drums and/or drum remnants are located at the ground surface in the three areas specifically identified for the disposal of solid waste in the O'Connor Trucking and Haulage Company contract: the Peters Mine pit area, the Cannon Mine pit area, and the area historically referred to as the O'Connor Disposal area.
- Paint sludge deposits have been identified at nine locations (SR-1, SR-2, SR-3, SR-4, SR-5, SR-6, SR-7, SR-8, SR-9) outside of the three designated disposal areas as shown on Figure 5. Paint sludge has been excavated from two of the nine areas. Plans are in development to address paint sludge from the seven other areas.
- The survey identified drums and/or drum remnants on the surface of the former Borough of Ringwood municipal landfill; however, no paint sludge was observed and the drums and/or drum remnants are likely not associated with Ford because the Borough accepted a wide variety of waste materials over a number of years in that area. Also, the Borough's landfill operated from approximately 1972 to 1976 – a period that post-dated Ford's use of the Site. The Borough also engaged in disposal activities at the Site prior to 1972, using areas of the Site, such as the Cannon mine area. Drums and/or drum remnants were also identified within and outside the three designated disposal areas at the locations identified on Figure 6. In accordance with the procedures described in a June 15, 2005 letter from ARCADIS to EPA, the majority of the surficial drums and drum remnants identified during the survey were removed and placed within a dedicated management area for characterization and disposal.
- Miscellaneous household trash, abandoned vehicles, and other debris were found on greater than fifty percent of the area surveyed. It appears that this debris has been dumped by third parties over many years. The debris impeded the Survey work and it will complicate follow-up investigative and remedial work. Locations where debris was identified are shown on Figure 7.
- Areas filled shortly before and during the period of Ford ownership were identified. A work plan module to perform a subsurface test pit survey of these areas has been submitted to the EPA for review and approval.

Additional Investigative and/or Remedial Activities Proposed

- An area-specific investigative work plan for the Peters Mine Pit Area has been submitted to the EPA for review and approval. Similar work plans are being prepared for the Cannon Mine Pit Area and O'Connor Disposal Area.
- Paint sludge has been removed from Sludge Removal (SR) Areas SR-1 and SR-2, and work plans to address the remaining areas are being prepared. Areas subject to paint sludge removal activities are shown on Figure 2.
- The work plan module to perform a subsurface test pit survey at locations filled during the period of Ford ownership has been submitted to the EPA for review and approval. Locations proposed for investigative test pit activities are shown on Figure 8.

2. Site Background

This section provides a summary of Site background information, including site history, regulatory history, and previous removal actions.

2.1 Site History

The property on which the Site is located is in the northeastern corner of Passaic County, New Jersey within the southeastern extension of the Highlands of the New England Physiographic Province. The Highlands consist of crystalline bedrock forming prominent ridges. Valleys are typically “filled” with unconsolidated glacial deposits that overlie the bedrock. Magnetite mines operated on the Site as early as the 1700’s. Commercial mining operations continued until at least the early 1930’s. The approximately 870-acre property, which includes the Site, was purchased from private owners by the U.S. Government in 1941 and later sold to Pittsburgh Pacific Company, a Minnesota-based mining company, in 1957. Pittsburgh Pacific Company sold the property to the Ringwood Realty Corporation (Ringwood Realty), a former subsidiary of Ford, in January 1965. The general Site setting is shown on Figure 1.

The Site is situated on approximately 500 of the 870 acres purchased by Ringwood Realty. The Site is bordered on the South by Mine Brook, which flows south of Margaret King Avenue, on the East by the utility right-of-way sold to Public Service Electric & Gas (PSE&G) in 1970, on the West by property owned by Tuxedo Homes, Inc. and on the North by the northern portion of the Peters Mine works.

The Site consists of rugged forested areas, open areas overgrown with brush, abandoned mine structures, sealed mine shafts, filled mine pits, the former Borough of Ringwood Landfill, an industrial refuse disposal area, miscellaneous surface dumping areas, a municipal recycling center, the Ringwood Borough garage, and approximately 50 private residences located north of Margaret King Avenue in Ringwood, New Jersey.

Shortly after Ringwood Realty purchased the Site, Ringwood Realty financed and performed a significant cleanup activity, which included, among other things, the sealing of mine shafts and filling of mine pits. Period photographs indicate that third parties had disposed of junked automobiles on the Site and in some of the mine pits prior to Ringwood Realty's ownership.

Ringwood Realty owned the Site for only a brief period and commenced conveying portions of the Site via sales and donations beginning in November 1969. By November 1970, Ringwood Realty had divested itself of all but 145 acres of the Site. By December 1973, Ringwood Realty no longer owned any portion of the Site.

From approximately 1967-1971, O'Connor Trucking and Haulage Corporation (O'Connor), a Ford contractor, disposed bulky plant wastes from Ford's former assembly plant in Mahwah, New Jersey, including packing materials, cardboard, general plant trash, paint sludge, and drum remnants at the Site. Documents associated with Ringwood Realty's contract with O'Connor specifically identified three areas at the Site for the landfilling of waste materials: the Peters Mine pit area; the Cannon mine pit area; and the area historically referred to as the O'Connor Disposal Area. There is evidence that the Borough of Ringwood and the Township of West Milford also landfilled wastes at the Site during the period of Ringwood Realty ownership. There is also evidence that other parties engaged in significant, unsupervised dumping of waste at the Site prior to and subsequent to Ringwood Realty's ownership period.

Ringwood Realty donated 290 acres of the Site to the Ringwood Solid Waste Management Authority (RSWMA) in November, 1970. The RSWMA had been organized and created by ordinance by the Ringwood mayor and council in October 1970. After it acquired ownership of the majority of the Site, RSWMA continued to accept wastes from O'Connor/Ford until 1971, when Ford terminated its relationship with O'Connor. RSWMA also continued to accept wastes from the Borough of Ringwood. Beginning in 1972, the RSWMA operated a municipal landfill on this land in the vicinity of the Borough Garage, accepting residential and commercial waste

generated by the Borough of Ringwood and Township of West Milford. The State of New Jersey ordered the landfill closed in 1976.

Regulatory History

The Ringwood Mines/Landfill Site was added to the EPA National Priorities List (NPL) on September 1, 1983. Remedial Investigation (RI) activities were conducted between 1984 and 1988, and a Risk Assessment (RA) and Feasibility Study (FS) were completed in 1988. The FS recommended implementation of a long-term Environmental Monitoring Program (EMP), which was embodied in a Record of Decision (ROD) issued by EPA in 1988. Removal actions occurred in 1987 and 1988, prior to the completion of the RA and ROD, and subsequent removal actions took place in 1990, 1991, 1995 and 1997-98.

Based on the results of the RI/FS, RA, EMP, and supplemental investigation, EPA deleted the site from the NPL on November 2, 1994. Subsequent to deletion from the NPL, EPA required a number of additional removal actions, which Ford performed. In 2002, EPA determined that additional monitoring was no longer required.

In response to concerns raised by the community regarding the adequacy of the initial cleanup and the presence of paint sludge, EPA requested that Ford prepare a work plan to conduct an additional survey of the Site to identify and characterize any remaining areas of potential Ford-generated waste. ARCADIS prepared the CIWP in response to EPA's request.

The Field Reconnaissance Work Plan was presented by EPA at public meetings/workshops attended by residents, Borough of Ringwood government officials and attorneys representing residents on November 4, 2004, December 13, 2004, and May 12, 2005. In each meeting EPA and ARCADIS representatives requested community information about any known areas of paint sludge and drum remnants.

The Field Reconnaissance Work Plan was the first step or module of the CIWP. Additional area-specific or media-specific investigative work plans have also been prepared for Surface Water & Sediment Sampling (Module 2), The Peter's Mine Pit Area (Module 3), Residential Surveys (Module 4), and Identified Fill Areas Follow-up Reconnaissance/Test Pit Survey (Module 5). Work plan modules for the Cannon Mine Pit Area (Module 6) and O'Connor Disposal Area (Module 7) are in preparation.

Ford and ARCADIS implemented paint sludge removal activities during December 2004. Paint sludge within SR-1 and SR-2 has already been removed, and excavation activities for SR-3 are set to begin, with completion during the Fall of 2005. Paint sludge removal at SR-4 and SR-6 through SR-9 will follow.

2.2 Previous Removal Actions

Previous removal actions have involved the excavation and off-site disposal of paint sludge and drums. The locations of the removal actions are shown on Figure 2. The following removal actions have occurred at the Ringwood Mines/Landfill Site:

- 1987 to 1988: 7,000 cubic yards of paint sludge from locations A, B, C, and D (Figure 2);
- 1990 to 1991: 600 cubic yards of paint sludge and 54 drum remnants from the southern portion of the O'Connor Disposal Area;
- 1995: 5 cubic yards of paint sludge from the utility right-of-way north of Van Dunk Lane;
- 1997-98: 100 cubic yards of paint sludge from southern portion of the O'Connor Disposal Area.
- December 2004 to Date: Approximately 3,600 tons of paint sludge from Sludge Removal Areas SR-1 and SR-2. Approximately 90 drums and/or drum remnants have also been removed. The field activities for the removal actions are described in the field activities reports previously submitted to EPA.

3. Determination of Study Areas

The following sections provide a description of the resources used to identify the areas that were included in the Field Reconnaissance Survey.

3.1 Information Sources

The sources of information described below were analyzed in the screening process to select the areas of the Site which would be subject to the Field Reconnaissance Survey. The screening process was employed to delineate the areal extent of the Field

Reconnaissance Survey, which was designed to achieve the objectives identified in Section 1.0.

O'Connor Landfill Areas: Historical research has identified three areas at the site that were explicitly identified by the site owner for the landfilling of wastes during the period that O'Connor brought wastes from Ford's former Mahwah assembly plant to the Ringwood site. These three areas include: the Peters Mine pit area; the Cannon Mine pit area; and the so-called O'Connor Disposal area. Two maps associated with the O'Connor contract with Ford identify these areas, and a former officer of O'Connor Trucking, Russ Kerestes, has confirmed that O'Connor utilized the three delineated areas for the landfilling of waste materials. An overview of the site showing these areas is attached as Figure 2. Maps identifying locations for landfilling under Ford's contract with O'Connor are provided within Appendix A. It should be noted that at least one of the areas – the Cannon Mine area – also was used historically for waste disposal by other entities including, in particular, the Borough of Ringwood.

Aerial Photographs: Aerial photographs from the years 1940, 1951, 1959, 1966, 1969, 1974, and 1980 are a part of a document entitled "Ringwood Mines and Landfills – Volume 2, Ringwood, New Jersey", prepared by Environmental Monitoring Systems Laboratory and U.S. Environmental Protection Agency (October 1983), were analyzed. These photographs were enlarged to a scale of 1 inch equals 200 feet, which corresponds to the scale of the Site base map. Interpretation of these photographs was supplemented with aerial photographs from 1979, 1984, and 2002.

Aerial Photographs: Aerial photographs from the years 1940, 1961, 1969, 1974, and 2003 were also obtained from photogrammetric archival sources.

Buildings (including residences); paved and unpaved roadways; former mine workings (including pits); forested and non-forested areas; and water bodies (brooks, ponds and mine pit pools): These areas are generally identifiable in the aerial photographs. The information from the aerial photograph review was used to identify and map disturbed areas, depressions, and access roads. Depressions, such as large and small mine pits, present at or about the time Ringwood Realty purchased the Site, which appear to have been modified or eliminated during the period of Ringwood Realty ownership (between 1965 and 1973) and areas that appear to have been disturbed during the Ringwood Realty ownership period are considered, for purposes of the investigation, to be areas that may potentially contain Ford-generated waste. Road shoulders, level areas, and ravines adjacent to roadways that were present and accessible during the Ringwood Realty ownership period are considered, for purposes of this investigation,

to be potential areas for paint sludge or drum disposal, and, therefore, appropriate areas for the Field Reconnaissance Survey.

Locations of Previously Identified Paint Sludge and Drums: Past work at the Site has included the identification of paint sludge disposal locations and a drum disposal location and the subsequent removal of the sludge and drums. The locations of previously-removed and recently-identified sludge and drum remnants were instrumental in assessing the “landscape position,” which is the relationship between access roads, topography, and areas where wastes were or could have been disposed during the Ringwood Realty ownership period. For example, the landscape position, or presence of paint sludge on the slope of a ravine adjacent to a roadway accessible during the Ringwood Realty ownership period, suggests that any ravine adjacent to a roadway accessible by truck during this period potentially could be a paint sludge disposal area, and, therefore, appropriate for the Field Reconnaissance Survey.

Historic Mapping of the Site: ARCADIS obtained, from photogrammetric archival sources, stereo aerial photographs from December 1961 and April 1974 and prepared topographic maps of the Site. These particular aerial photographs were selected from available archival resources because they pre-date and post-date most closely the period during which O’Connor landfilled Ford wastes at the Site (approximately 1967-1971). The topographic maps were electronically compared using AutoCAD software to identify areas where ground elevation changed during the 1961-1974 period. These period topographic maps showed disturbed areas, paved and dirt roads, and topographic features. This information was used to supplement the interpretation of aerial photographs and refine the areas subject to the Field Reconnaissance Survey. Areas that show evidence of filling between 1961 and 1974 were also included within the Field Reconnaissance Survey.

Input from Community: The Field Reconnaissance Work Plan was presented by EPA at public meetings/workshops attended by residents, Borough of Ringwood government officials, and attorneys representing residents on November 4, 2004, December 13, 2004, and May 12, 2005. In each meeting EPA and ARCADIS representatives requested community information about any known areas of paint sludge and drum remnants.

Screening Process

The objective of the screening process was to determine the areal extent of the Field Reconnaissance Survey. Areas that could not have been realistically or logistically used for disposal (e.g., areas on steep slopes uphill from any access roads and areas that show no evidence of disturbance) were also identified as a means of limiting the extent of the survey.

The step-wise screening approach used to review Site information was as follows:

- **Step 1: Identify and Map Historically Designated Landfill Areas.** The three designated landfill areas shown on the O'Connor Maps were mapped on an AutoCAD layer used to produce Figure 2 and were investigated during the Field Reconnaissance Survey.
- **Step 2: Identify and Map Areas Where Paint Sludge and Drums Have Been Removed or Recently Identified.** The former and current paint sludge and drum locations were mapped, with one exception: recently-identified locations that were outside the areas mapped in Step 1, but within the disturbed areas or along the access roads mapped in Step 3, were subject to the Field Reconnaissance Survey.
- **Step 3: Identify and Map Disturbed Areas from Aerial Photographs.** Disturbed areas that existed at the conclusion of Ringwood Realty's ownership were mapped based on an April 1974 aerial photograph of the Site and were investigated during the Field Reconnaissance Survey.
- **Step 4: Identify and Map Period Access Roads from Aerial Photographs.** Period access roads were mapped using aerial photographs from the time of Ringwood Realty's ownership. ARCADIS delineated and mapped a 25-foot wide corridor on each side of the identified access roads and investigated these areas during the Field Reconnaissance Survey.
- **Step 5: Identify and Map Depressions from Aerial Photographs.** Surface depressions evident in the April 1959, December 1966, April 1969, and April 1974 aerial photographs were identified. The foot prints of these surface depressions were within the areas mapped under Step 3 and were investigated during the Field Reconnaissance Survey.

- **Step 6: Map Level Areas along Access Roads.** Areas adjacent to access roads that existed during the period of Ford's ownership and that are sufficiently level for a waste hauling truck to have accessed were mapped and investigated during the Field Reconnaissance Survey.
- **Step 7: Map Ravines along Access Roads.** Ravines adjacent to access roads or level areas could have been used to dispose of wastes; therefore, these areas were investigated during the Field Reconnaissance Survey.
- **Step 8: 1961 / 1974 Digital Topographic Elevation Comparison.** Topographic maps of the Ringwood Site from 1961 and 1974 were compared digitally to create the 1961-1974 Topographic Elevation Comparison Map (Figure 3). This figure illustrates any elevation change greater than one foot occurring between 1961 and 1974.
- Input from Community: The Field Reconnaissance Work Plan was presented by EPA at public meetings/workshops attended by residents, Borough of Ringwood government officials and attorneys representing residents on November 4, 2004, December 13, 2004, and May 12, 2005. In each meeting EPA and ARCADIS representatives requested community information about any known areas of paint sludge and drum remnants.

Applying these steps, ARCADIS developed guidelines to identify non-residential areas that could not have reasonably been used for waste disposal during Ringwood Realty's ownership period and did not require further investigation. These guidelines eliminated the following areas from further study:

- **Areas without Historical Access Roads.** Historic aerial photographs were analyzed to delineate areas that did not have access roads, which were suitable for truck traffic, at the time of Ringwood Realty's ownership. These areas were not subjected to further Field Reconnaissance Survey.
- **Steep Slopes and High Elevations above Access Roads.** Recent and historic topographic maps were analyzed to delineate areas with elevations higher than the 20 foot-wide access road corridor described in Step 4 above. These areas were not subjected to further Field Reconnaissance Survey.

Regardless of these guidelines, ARCADIS investigated each non-residential area for which information indicated that a given area could have been used for disposal. Areas

that were included in the Field Reconnaissance Survey are indicated in yellow and presented within Appendix B. The areas excluded by the screening process and not included in the survey are indicated in green.

4. Survey Methodology

The Field Reconnaissance Survey was conducted in a multi-step process. The steps taken to conduct the Field Reconnaissance Survey are detailed in this section.

4.1 Preparatory Tasks

A Field Reconnaissance Survey Map, showing the areas to be included in the survey, was developed based on historical document review and the screening process described in Section 3. In order to systematically investigate the study areas and accurately map any paint sludge or drums discovered during the investigation, a systematic procedure was developed for the survey. This section describes the procedure used for the investigation.

Subdivide and Label Units: The Field Reconnaissance Survey areas were subdivided into units based on natural boundaries, human-made boundaries, and other site features. The units were labeled with a numeric code that provided a unique identification number for each unit in order to facilitate information and data management. Survey areas are identified by number on the Reconnaissance Survey Map in Appendix B.

Establish Survey Lines/Download to GPS: Prior to initiating the Field Reconnaissance Survey, 50-foot interval survey lines were established on a digital map of each unit. Nodes were established along each survey line at 25-foot intervals. Survey line and grid node numeric identifiers were established, and the coordinates for the lines were determined from the digital map and recorded. Each of these coordinates was downloaded to a Leica GS-20 Global Positioning System (GPS) and data-logger unit (See Appendix C), which is accurate to within ± 1 meter horizontal and vertical.

Conducting the Field Reconnaissance Survey: By downloading the coordinates of the survey areas into the GPS, the Field Reconnaissance Survey Crew could determine their location on-site at all times. The Survey Crews used the GPS to walk each survey line and record data at each node. Data collected at each node included physical attributes and site characteristics as defined in a preset code list of possible site

characteristics. At the end of each day, the GPS unit data was downloaded into the associated software and plotted on digital maps.

4.2 Execution

Each Field Reconnaissance Survey team consisted of two personnel trained to recognize paint sludge, drums, drum remnants, and soil conditions indicative of waste fill materials. The Field Reconnaissance Survey for each unit was initiated daily by checking the configuration of the GPS's navigation system, satellite availability, and real time beacon correction to assure the survey proceeded efficiently and accurately. The field accuracy of the GPS is affected by factors such as the time of day, overhead power lines or vegetation, and topographic features.

During the Field Reconnaissance Survey, the team assessed the ground surface conditions along and adjacent to the survey line (up to 25 feet on each side of the node) as they proceeded. Ground surface conditions were determined by clearing debris and vegetation surrounding the node and performing visual inspections. At and in the vicinity of some nodes, the ground surface was not visible due to thick vegetation, downed debris, refuse piles, swamps or surface water bodies, buildings, foundations, or other structures. In these restricted areas, the survey was conducted to the extent that conditions would permit. The team documented the node area with photos and made notes into the field book describing the location and limiting factors.

Subsurface (1-2 feet below ground surface) observations were made at each node. The subsurface conditions were determined based upon visual inspection of a soil sample taken via the use of a stainless steel soil probe. If the probe was unable to fully penetrate the ground surface, increased downward force was applied to the probe in an attempt to dislodge or bypass the source of refusal. While not able to penetrate bedrock and/or boulders, the soil probe was capable of partially penetrating the paint sludge material; therefore, the tip of the soil probe was inspected for the presence of paint sludge. At those nodes where refusal was encountered with the first attempt, up to three additional probe attempts were made in the immediate area of the node. Three to five subsequent cores were collected within a 25 foot radius of each node while the reconnaissance survey data were being entered into the GPS unit. The additional cores provided a more comprehensive view of subsurface conditions. For these extra cores, ones which contained paint sludge or drum material were noted in the GPS unit and field log book.

The GPS was used to direct the survey team from each node along the survey line to the subsequent node. Each Field Reconnaissance Survey team walked parallel survey lines spaced 50 feet apart, until the entire unit had been surveyed. While walking the survey line, the field teams observed conditions along the survey line and between survey lines. All observations of paint sludge, drums, or refuse were recorded in the GPS data logger.

The ground-surface and subsurface observations were logged in a bound field book or the GPS data-logger. The information recorded included, but was not limited to, the following:

- Presence and condition of paint sludge, drums, and/or drum remnants;
- Presence of refuse and discernable fill material;
- Description of areas inaccessible to survey due to dense vegetation, topography, and/or obstructions;
- Photographic identification information;
- Survey point coordinates recorded by the GPS; and
- Other general observations.

4.3 Data and Information Management

The Field Reconnaissance Survey commenced on December 8, 2004 and proceeded until January 5, 2005, when the Survey was suspended due to snow cover. The Survey resumed on April 5, 2005 and was completed on September 9, 2005.

Stored GPS data were downloaded nightly and electronically stored using GIS DataPRO version 3.20.21. The downloaded data were then exported from GIS DataPRO as a file compatible with AutoCAD-based applications. The files were imported into AutoCAD, where maps were produced to show the locations of paint sludge, drums and/or drum remnants and waste materials within the designated survey areas. Locations without known or suspected waste disposal were also identified in the mapping system. These site material location maps were updated weekly during the reconnaissance survey as new data were being collected. All GPS survey data were backed up on CDs and also placed on the project server directory. ARCVIEW 9.0 and

ARCInfo 9.1 were also used to create figures and manage a database for the survey data.

4.4 Quality Assurance

The field observation information generated during the survey was reviewed frequently to ensure that its quality was acceptable and sufficient to achieve the objectives. The information quality was assessed in terms of the following questions:

- Is there an observation for each node?
- Is the field observation unambiguous?
- Is the density of observations consistent with the established 50-foot line spacing and 25-foot nodes?

If the answer to any question was no, then corrective actions were implemented that included the following components:

- Record or clarify an observation by returning to the point in question. This follow-up action was taken when a key observation was not made or the observation was ambiguous.
- Obtain additional observations in the field. This follow-up action was taken if one or more nodes in an area were not covered during the Field Reconnaissance Survey. Downloading and plotting the observation points identified portions of the units that may not have been adequately covered due to the presence of dense vegetation, large debris piles, or inadequate satellite coverage. Where possible, measures were taken to remove or minimize obstructions, such as brush clearing, and the survey was reattempted in those areas.

Quality control measures were implemented to ensure that in-field data collection was accurate and complete. These measures included:

- Nightly downloads of survey data into the GIS;
- Exporting ASCII text and reviewing for completeness;

- Download and label photographs, making certain the photographs match their descriptions in the field book; and
- Weekly (or when requested) imports of survey data into AutoCAD and updating of progress maps to ensure all survey nodes and data were imported to the appropriate and designated survey areas.

The reconnaissance survey screening process was validated by performing a “control” survey within an area that did not meet any of the screening criteria detailed within Section 3.2. These criteria for selecting the control area included:

- That during the period of Ringwood Realty’s ownership it may have been accessible to truck traffic;
- It was not identified as an area of cut or fill from the topographic comparison between 1961 and 1974;
- Stereoscopic analysis of the aerial photos from 1961 and 1974 did not identify it as an area of disturbed vegetation; and
- It did not include a former sludge removal area.

No paint sludge, drums or drum remnants were observed within the control area selected to validate the process, indicating that the screening process followed was valid.

5. Field Reconnaissance Survey Findings

The screening process described in Section 3.2 identified approximately 97 acres of the Site for the Field Reconnaissance Survey Map in Appendix B. The Field Reconnaissance Survey team covered approximately 93,000 linear feet of survey line and collected data at 4,610 nodes. A visual inspection at each of these locations resulted in the following general findings:

- Approximately 20% (97 acres) of the site was subject to the reconnaissance survey based on the screening process outlined within Section 3.2;

- Potential Ford-related waste materials (such as paint sludge, drums or drum remnants) were detected at six percent of the 4,610 locations inspected, and these materials were observed in distinct site areas as shown on Figures 5 and 6;
- Non-Ford-related refuse (e.g., automobiles, steel-belted radial tires, construction materials and domestic refuse [refrigerators, washing machines, roofing shingles, bicycles, clothing, children's toys]) were observed at more than 50% of the locations.

A description of the locations where paint sludge, drums and/or drum remnants, and refuse were observed is provided in the following sections.

5.1 Paint Sludge

Of the 4,610 nodes surveyed, paint sludge, either as individual pieces or as a continuous flow, was observed on the surface or in the soil core at four percent of the locations inspected, and primarily within the O'Connor Disposal Area, the Peters Mine Pit area and the Cannon Mine area. Groupings of nodes with paint sludge have been assigned unique identification labels using the prefix SR followed by a number designated for that area (e.g., SR-1, SR-2, SR-3). Each paint sludge area is discussed below.

SR-1 and SR-2

Areas SR-1 and SR-2 contained continuous deposits of paint sludge. The paint sludge deposits were in low lying areas immediately west and east of the edge of Hope Mountain Road, respectively. Paint sludge in these two areas was excavated in January and April-June. The excavations were back-filled with certified clean fill in May and August 2005. Plantings for final cover will be completed in the Fall of 2005. The locations of SR-1 and SR-2 are shown on Figure 2.

SR-3

Area SR-3 is located within the northernmost portion of the former O'Connor Disposal Area in a low-lying area immediately east of Peters Mine Road. Paint sludge within SR-3 is scheduled for removal during September/October 2005. The SR-3 location is shown on Figure 2.

SR-4

The SR-4 area is a paint sludge deposit located west of SR-3 in a low-lying area adjacent to an extension of Peters Mine Road. ARCADIS has submitted a permit application to the NJDEP and the conservation district to perform this removal. The SR-4 location is shown on Figure 2.

SR-5

The SR-5 area is located immediately north of the Peters Mine Pit area. The Field Reconnaissance Survey team identified pieces of paint sludge and drum remnants on the surface in this area. Surficial drums and drum remnants from within this area have been removed. Subsurface drums and paint sludge remaining within this area will be addressed as part of the Peter's Mine Pit Area Work Plan currently being reviewed by the EPA.

SR-6

The SR-6 area is situated west of Van Dunk Lane at the top and on the side of a steeply wooded hill near the former New London Pit (Cannon Mine Investigation Area). The exposed areas of paint sludge are intermingled with household waste, debris, boulders, and rock outcrops. The extent of paint sludge, drums and/or drum remnants within this area will be addressed as part of the Cannon Mine Pit Area Work Plan currently being prepared by ARCADIS. A plan to remove loose pieces of paint sludge and drum remnants on the surface of the SR-6 area has been submitted to EPA for review and approval.

SR-7

The SR-7 area is located in a low-lying area, immediately east of Hope Mountain Road, within and adjacent to an area where paint sludge was previously removed in 1988. The Field Reconnaissance Survey team identified a small paint sludge flow and a number of pieces of paint sludge in this area. ARCADIS is currently preparing permit applications for submittal to the NJDEP and the Hudson-Essex-Passaic County Soil Conservation District (HEPSCD) for approval prior to removing paint sludge at SR-7.

SR-8

The SR-8 area is located approximately 1,800 feet north of areas SR-1 and SR-2, in a low-lying area immediately adjacent to Hope Mountain Road. Pieces of paint sludge have been found to be mixed with trash and debris. The SR-8 area will be investigated further as part of the Test Pit Survey Work Plan, which has been submitted to EPA for review and approval.

SR-9

The SR-9 area is located approximately 900 feet north of SR-1 and SR-2, in a steep ravine extending east of Hope Mountain Road. The Field Reconnaissance Survey team identified a paint sludge flow as well as individual pieces of paint sludge. ARCADIS is currently preparing permit applications for submittal to the NJDEP and the Hudson-Essex-Passaic County Soil Conservation District (HEPSCD) for approval prior to removing paint sludge at SR-9.

O'Connor Disposal Area

Pieces of paint sludge and several drum and drum remnants were found in the O'Connor Disposal Area. This area will be investigated further as part of the O'Connor Disposal Area Work Plan being prepared by ARCADIS.

5.2 Drums and/or Drum Remnants

The Field Reconnaissance Survey team observed drums and/or drum remnants at two percent of the 4,610 nodes that were surveyed, and the majority of these were located within the four previously established disposal areas. Most of the drums and drum remnants were extremely corroded, contained no identifying markings and contained no liquid or solid contents. Nearly all of the surface remnants have been removed from the Site, excluding those located on the former Borough Landfill, and within a currently inaccessible area within the eastern portion of the O'Connor Disposal Area.

Drum remnants containing materials were wrapped and placed within the temporary staging area near the construction entrance for further waste characterization and subsequent off-site disposal, in accordance with the EPA-approved work plan.

The Field Reconnaissance Survey team identified two areas that contained sub-surface drums and drum carcasses. These two areas were the Peters Mine Pit area/SR-5 and the O'Connor Disposal area (Figure 6). These areas will be addressed as part of the aforementioned Work Plans.

5.3 Refuse

The Field Reconnaissance Survey team noted that more than 50% of the 4,610 nodes surveyed contained some type of trash, debris, commercial or household refuse. Much of the Site has been used for dumping throughout the years. Portions of the Site were previously operated as a municipal landfill, and several other areas appeared to have been used for uncontrolled dumping. There is also a significant volume of non-Ford related waste scattered randomly throughout much the Site. Areas of the Site where refuse was discovered are shown on Figure 7. Photographs of some of the refuse are provided within Appendix C.

6. Topographic Comparison Map Findings

As indicated previously, topographic maps of the Ringwood Site from 1961 and 1974 were compared digitally to create the 1961-1974 Topographic Comparison Map (Figure 3), which illustrates how 1974 topographic conditions differ from 1961 conditions. Any elevation change greater than one foot occurring during this period is shown on the figure. The thicknesses of cut or fill are indicated on the figure with varying intensities of yellow or blue shading, respectively.

Potential fill areas were identified across the site from the New York/New Jersey border at the northern end of the site to the Municipal Disposal area at the southern end of the site. Potential fill areas identified on the overlay map are summarized below by general geographic area. For each geographic area, a brief evaluation of the terrain in that area, the nature of fill observed (if any), and additional actions taken or proposed are included in the summary.

ARCADIS has prepared a focused work plan, submitted to the EPA under separate cover, outlining the number and location of test pits proposed within areas across the site. Proposed test pit locations are shown on Figure 8, and discussed in the sections that follow.

New York/New Jersey Border Area

Long, linear fill areas were observed adjacent to a trail/access road in this area. Neither paint sludge nor drum remnants were observed during the reconnaissance survey on the surface in this area, and access for waste hauling trucks would have been very difficult. There a few non-linear fill areas that will be further evaluated through the

excavation of test pits at representative locations as shown on Figure 8 and outlined within the Test Pit Investigation Work Plan submitted under separate cover.

Hope Mountain Road Area

Hope Mountain Road runs from the end of Peters Mine Road to the New York/New Jersey border, where it branches off into several smaller, steeper trails. Several sludge disposal areas have been identified in low-lying areas and ravines adjacent to Hope Mountain Road, including SR-1, SR-2, SR-3, SR-4, SR-7, SR-8, and SR-9. The topographic comparison map shows several additional areas of fill in low-lying areas adjacent to the road. These areas will be further evaluated through the excavation of test pits at representative locations as shown on Figure 8, and outlined within the Test Pit Investigation Work Plan submitted under separate cover.

Peters Mine Pit Area

The Peters Mine Pit area was one of the Site's two primary mining operations, and served as one of the three designated disposal areas for O'Connor Trucking during the period from 1967 to 1971. This area will be addressed under a focused investigative work plan.

O'Connor Disposal Area

The O'Connor Disposal area is located immediately adjacent to the eastern edge of Peters Mine Road, and served as one of three designated disposal areas for O'Connor Trucking during the period from 1967 to 1971. Paint sludge and drum remnants, along with industrial and domestic trash and debris, have been identified in this area. This area will be the subject of a focused investigative work plan.

Several locations southeast of the O'Connor disposal area have been identified on the topographic comparison map as having higher ground elevations. Visual inspection of these areas indicates that the higher ground elevations are associated with sediment deposition behind beaver dams. These areas will not be subject to further investigative activities.

Miller Pit/St. George's Pit Area

The Miller Pit/St. George's Pit area is located to the west of Cannon Mine Road. Fill areas associated with smaller mining pits are also located in this area. These areas will

be further evaluated through the excavation of test pits at representative locations as shown on Figure 8, and outlined within the Test Pit Investigation Work Plan submitted under separate cover.

Cannon Mine Pit Area/SR-6

The Cannon Mine Pit area was one of the Site's two primary mining operations, and served as one of the three designated disposal areas for O'Connor Trucking during the period from 1967 to 1971. Paint sludge disposal area SR-6 has been identified approximately 200 feet west of the Cannon Mine. The two areas will be addressed jointly under a focused investigative work plan.

Electric Sub Station

The electric substation is located immediately adjacent to the eastern edge of Peters Mine Road. Fill material associated with this area is associated with substation construction activities. No further activities are proposed for this location.

Intersection of Margaret King Avenue/Peter's Mine Rd

Areas of higher ground elevation in this area are associated with residential development in the area and include municipal debris and household rubbish. This area will be the subject of a survey by the USEPA.

Borough of Ringwood Municipal Landfill

Landfilling of municipal wastes by the RSWMA took place from 1972 until 1976, when the NJDEP required the Borough to cease all dumping activities at the site. Trash and debris, drums and drum remnants were found at this location. No paint sludge or other materials believed to be associated with Ford were found at this location and no further investigative activities are proposed.

Remote Mine Pit Locations

This area is located south of residences along Van Dunk Lane and southeast of the Cannon Mine area. It includes the Blue Pit and Mule Pit. Fill in this area may be structurally unstable and unsafe for heavy equipment, and no additional investigative activities are proposed at this time.

7. Interim Removal Actions

As part of the remedial efforts onsite, ARCADIS has overseen the removal of all accessible surface drums and drum remnants found outside of the former Borough Landfill area. The drums and drum remnants are being removed in accordance with the USEPA-approved Paint Sludge and Drum Remnant Removal Work Plan, Ringwood Mines/Landfill Site, Ringwood, New Jersey - 14 December 2004. Several drum remnants remain within the eastern portion of the O'Connor Disposal Area; however, these drum remnants will be relocated once access to this area is possible.

In addition, ARCADIS has identified isolated locations containing pieces of paint sludge within the O'Connor Disposal and Peters Mine Pit Areas. These isolated areas are not associated with any known continuous flows of paint sludge. The pieces of paint sludge appear to have been deposited at these isolated locations during subsequent site grading and landfill operations and do not appear to be a result of direct disposal. Isolated surficial pieces of paint sludge have been collected for disposal. Full scale paint sludge removal programs have been completed at SR-1 and SR-2. Similar removal programs will be implemented at SR-3, SR-4, SR-5, SR-6, SR-7, and SR-8, and SR-9. Buried drums and drum remnants observed in the O'Connor Disposal Area and the Peters Mine Pit area will be addressed as part of focused work plans.

Other activities will include the preparation and implementation of additional area-specific investigation work plans and remedial action work plans, if necessary.

8. References

Ringwood Mines and Landfills, Ringwood, New Jersey – Volume 2, United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory, TS-PIC-83044 (October 1983).

Plan for the Investigation of the Ringwood Mines/Landfill Site Module1: Work Plan for the Field Reconnaissance Survey – 23 November 2004.

Paint Sludge and Drum Remnant Removal Work Plan, Ringwood Mines/Landfill Site, Ringwood, New Jersey - 14 December 2004.

Appendix A

Maps Identifying Landfill Areas Under
O'Connor Contract

Appendix B

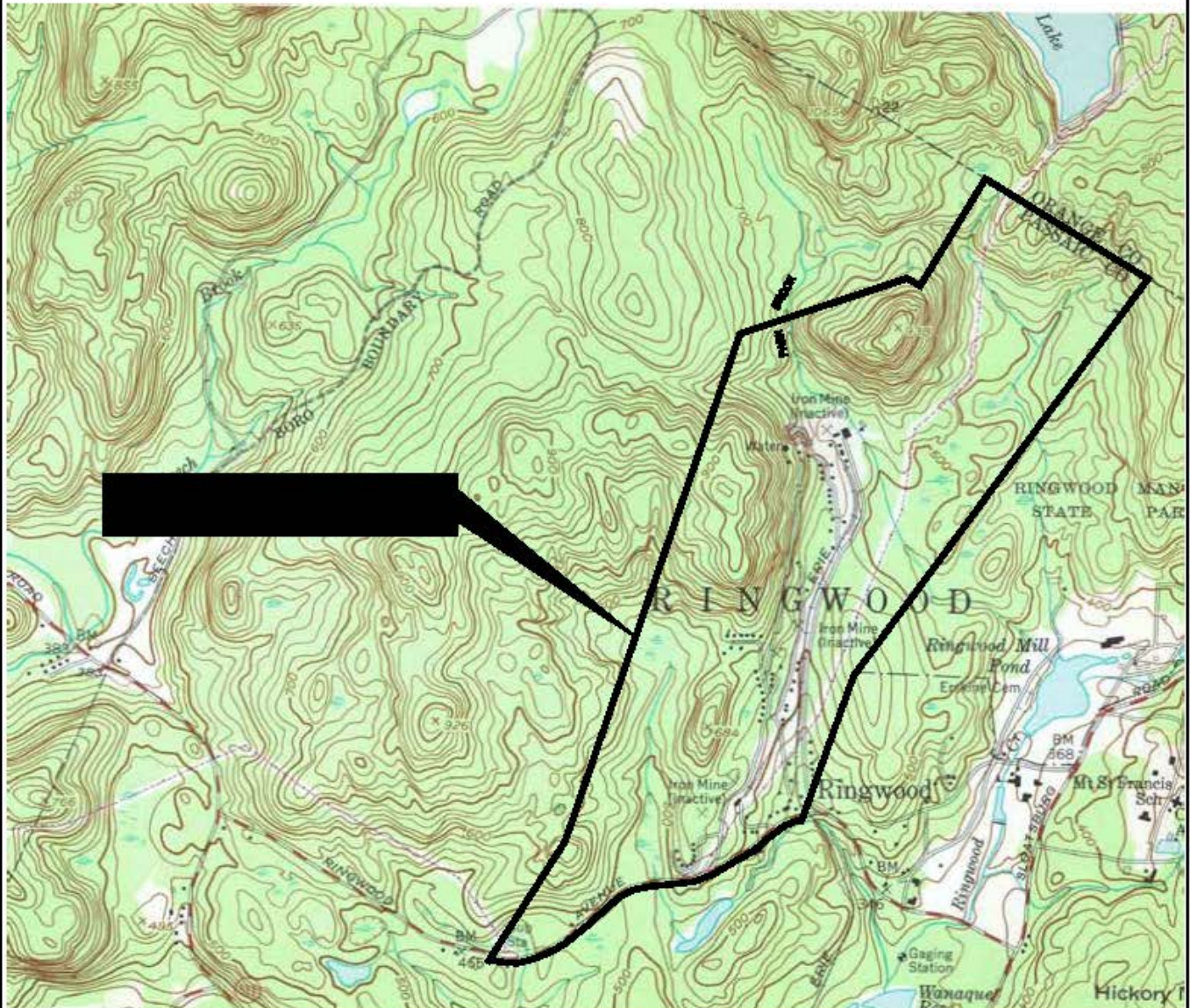
Reconnaissance Survey Map

Appendix C

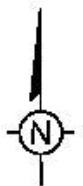
Photos of Non-Ford Related Refuse

Appendix D

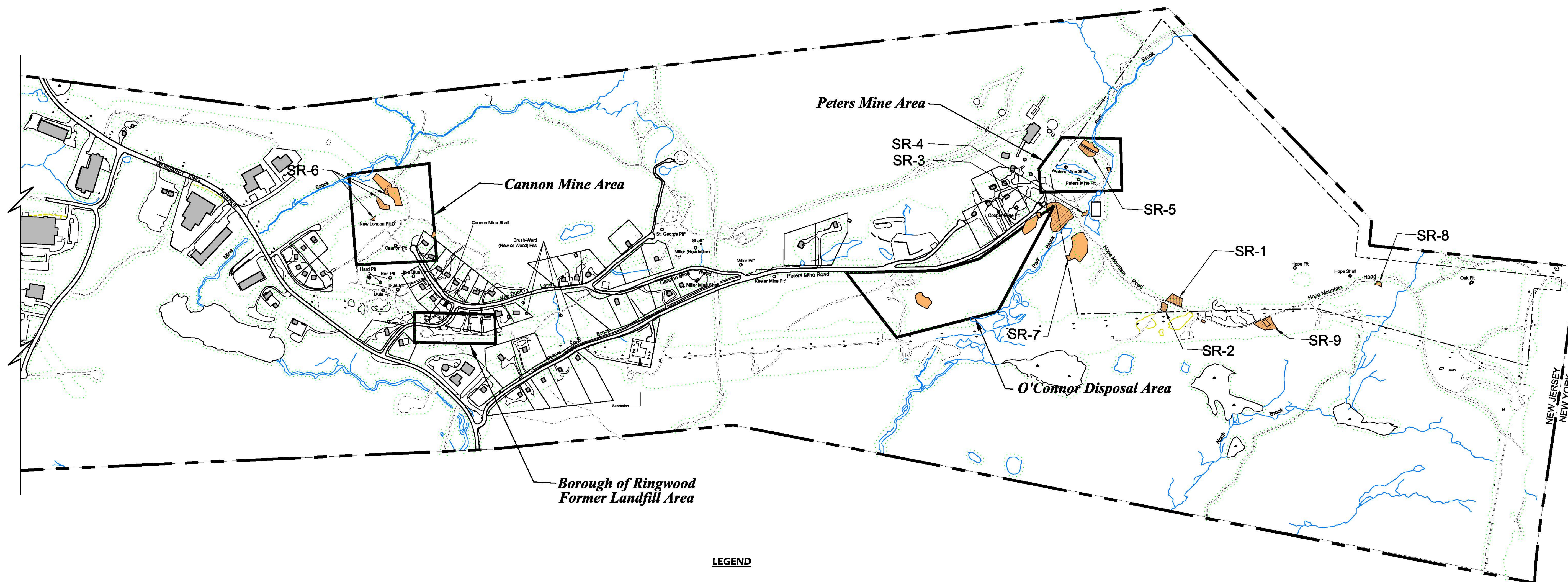
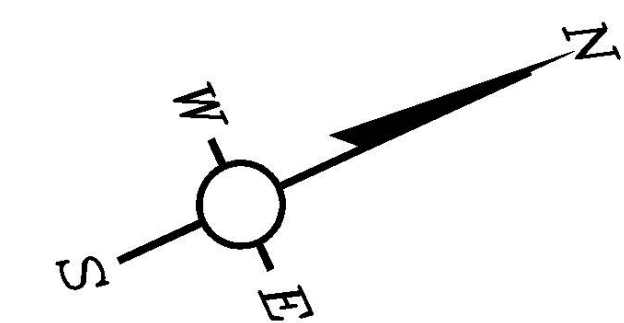
Leica GS-20 User Manual / Specs



REFERENCE: GREENWOOD LAKE, NY-NJ, USGS QUADRANGLE, 7.5 MINUTE SERIES, 1954.



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LEGEND

- TREELINE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- RINGWOOD STATE PARK BOUNDARY
- BUILDINGS
- TRANSMISSION LINE TOWER
- UTILITY POLE
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE
- CURRENT PAINT SLUDGE REMOVAL AREA (SR-3 THRU SR-9)
- 2004-2005 PAINT SLUDGE REMOVAL AREA COMPLETED TO DATE (SR-1 & SR-2)
- PRE-2004 PAINT SLUDGE REMOVAL AREA



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PROJECT MANAGER
E. CARMAN

DEPARTMENT MANAGER
C. MOTTA

LEAD DESIGN PROF.
J. ROCKLIN

CHECKED BY
E. ZIMMERMAN

SHEET TITLE

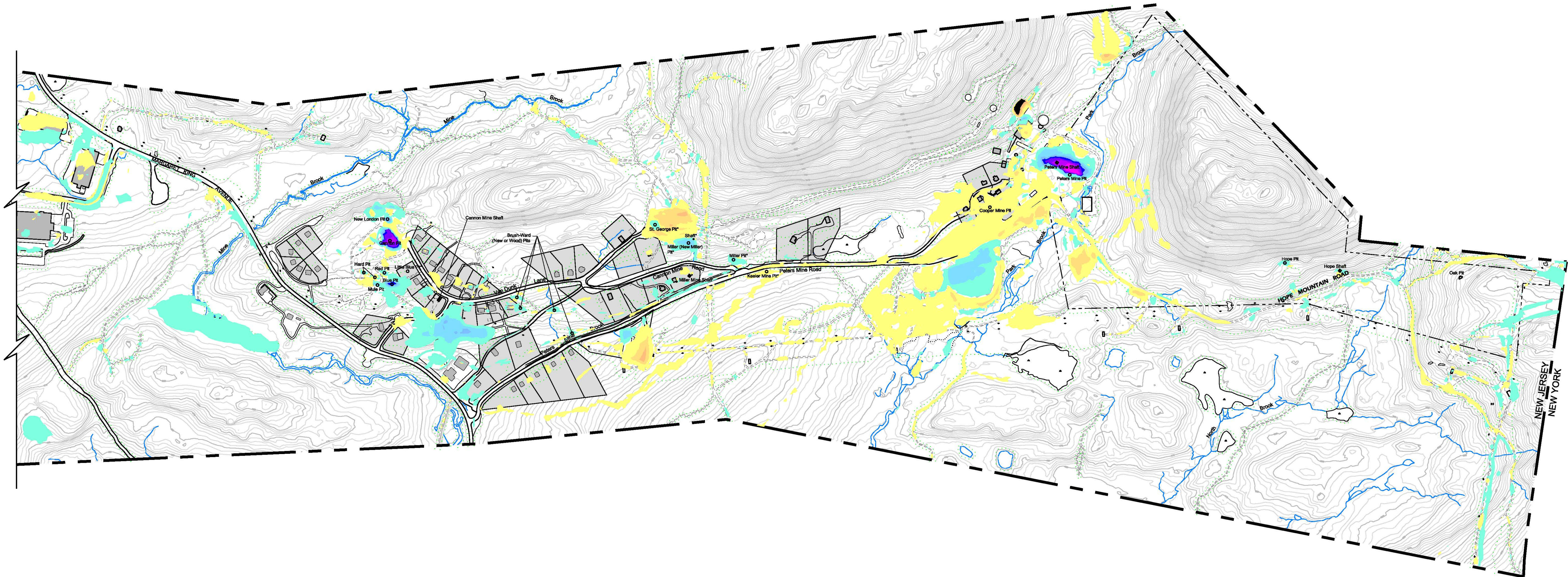
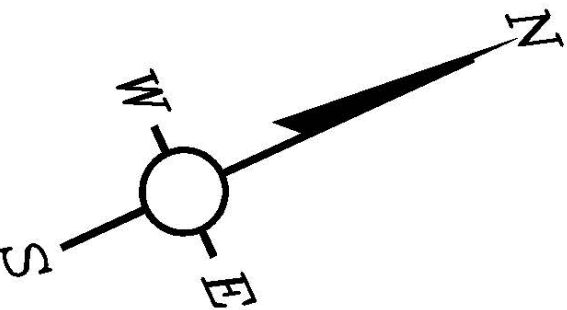
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PAINT SLUDGE REMOVAL AREAS

TASK/PHASE NUMBER
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PROJECT NUMBER
NJ000593.0009

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LEGEND

- TREELINE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- RINGWOOD STATE PARK BOUNDARY
- ELEVATION CONTOUR
- BUILDINGS
- RESIDENTIAL PROPERTIES
- TRANSMISSION LINE TOWER
- UTILITY POLE
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE

This map shows how the 1974 conditions differ from the 1961 condition. Only changes in elevation of +/- 1.0 feet are displayed.

Color	Range Beg.	Range End	
Black	-50.00	-40.00	Cut—1974 Ground elevations are lower than in 1961.
Dark Grey	-40.00	-30.00	
Light Grey	-30.00	-20.00	
Yellow	-20.00	-10.00	
Light Green	-10.00	-1.00	
White	-1.00	1.00	
Light Blue	1.00	10.00	Fill—1974 Ground elevations are higher than in 1961.
Medium Blue	10.00	20.00	
Dark Blue	20.00	30.00	
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Purple	40.00	60.00	
Dark Purple	60.00	80.00	
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LEAD DESIGN PROF.
J. ROCKLIN

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SHEET TITLE
1961/1974 TOPOGRAPHIC
COMPARISON MAP

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PROJECT NUMBER
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LEAD DESIGN PROF.
J. ROCKLIN

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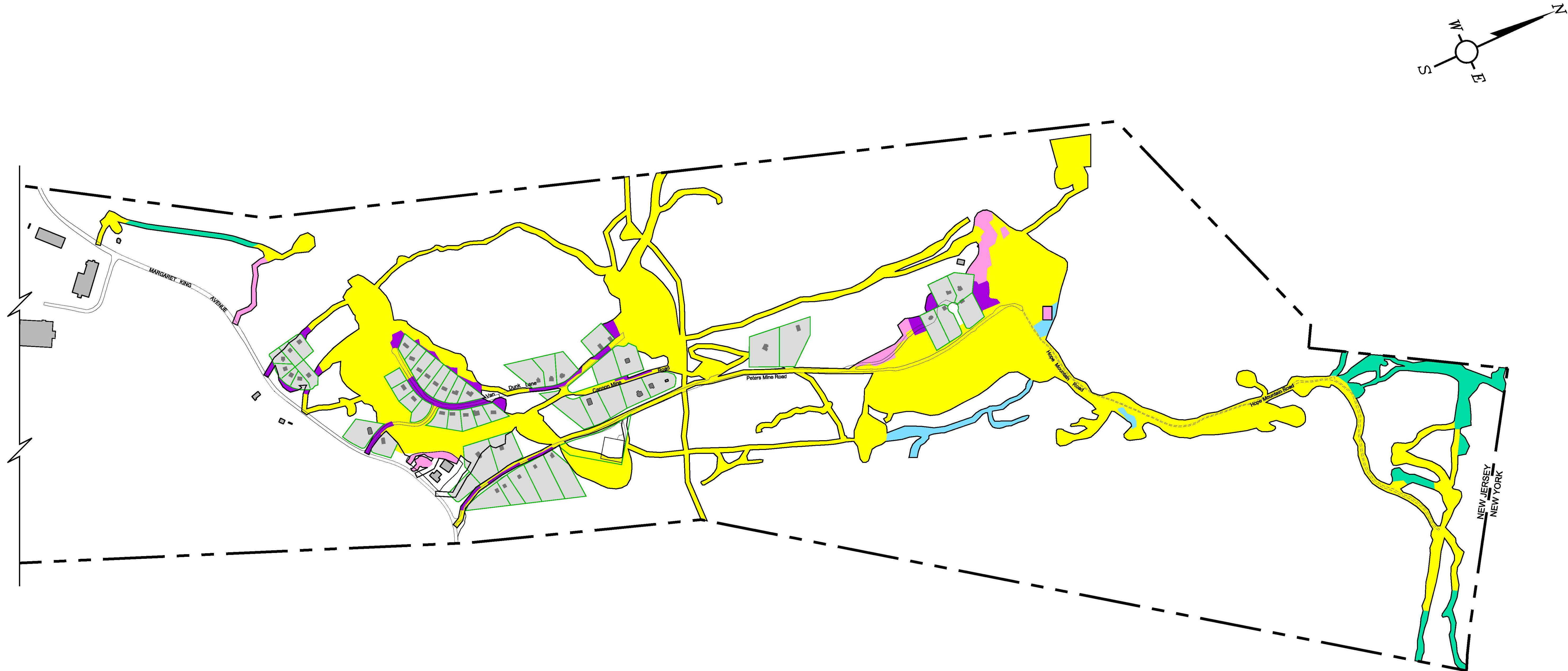
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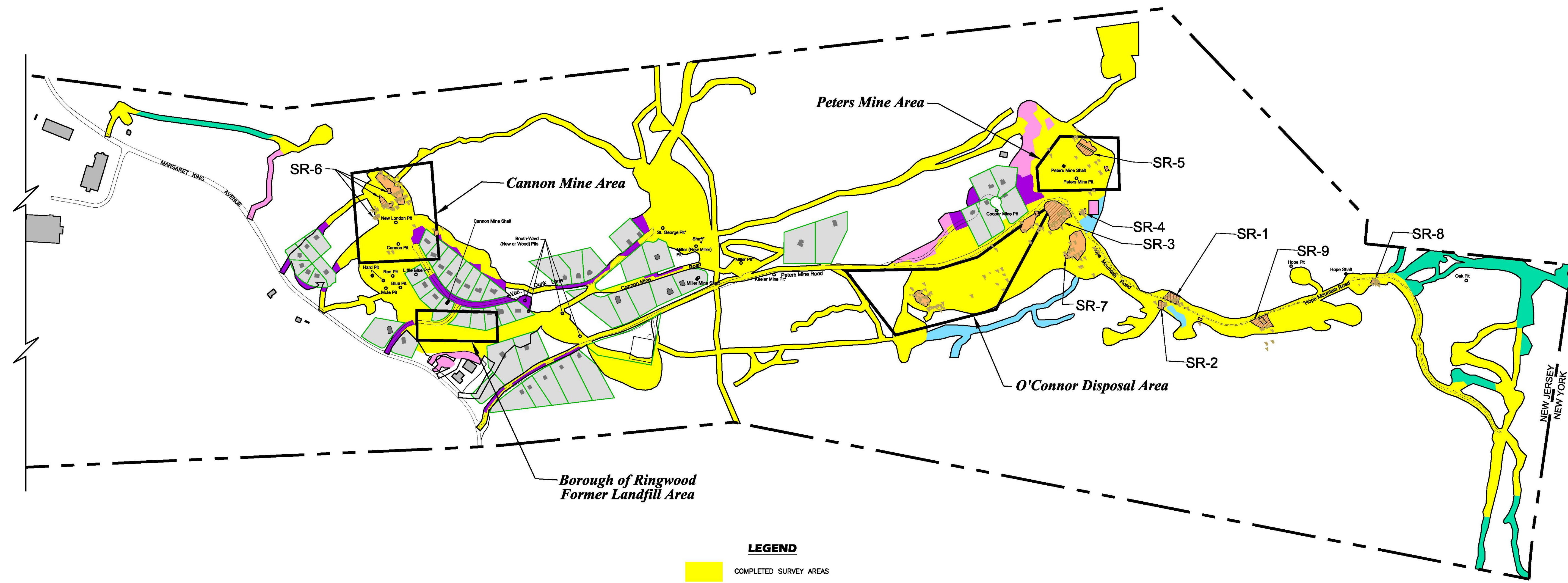
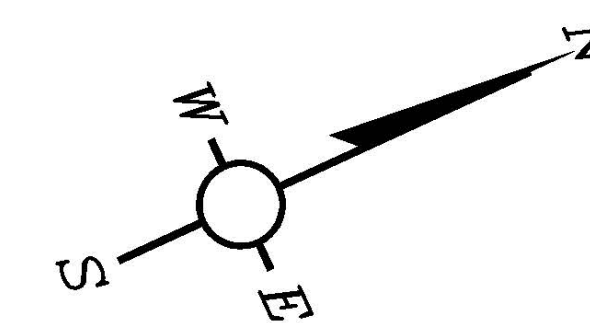
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- NOT SURVEYED BECAUSE OF PRESENCE OF PERMANENT STRUCTURE
- NOT ACCESSIBLE TO TRUCK TRAFFIC (atv trails, hiking trails, etc.)
- RESIDENTIAL PROPERTIES (TO BE SURVEYED BY USEPA)
- BUILDINGS



LEGEND

- COMPLETED SURVEY AREAS
- CURRENTLY USED BY RESIDENCES (TO BE SURVEYED BY USEPA)
- NOT SURVEYED BECAUSE OF STANDING WATER
- NOT SURVEYED BECAUSE OF PRESENCE OF PERMANENT STRUCTURE
- NOT ACCESSIBLE TO TRUCK TRAFFIC (atv trails, hiking trails, etc.)
- RESIDENTIAL PROPERTIES (TO BE SURVEYED BY USEPA)
- BUILDINGS
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE
- VISUALLY OBSERVED PAINT SLUDGE
- CURRENT PAINT SLUDGE REMOVAL AREA (SR-3 THRU SR-9)
- 2004-2005 PAINT SLUDGE REMOVAL AREA COMPLETED TO DATE (SR-1 & SR-2)
- PRE-2004 PAINT SLUDGE REMOVAL AREA

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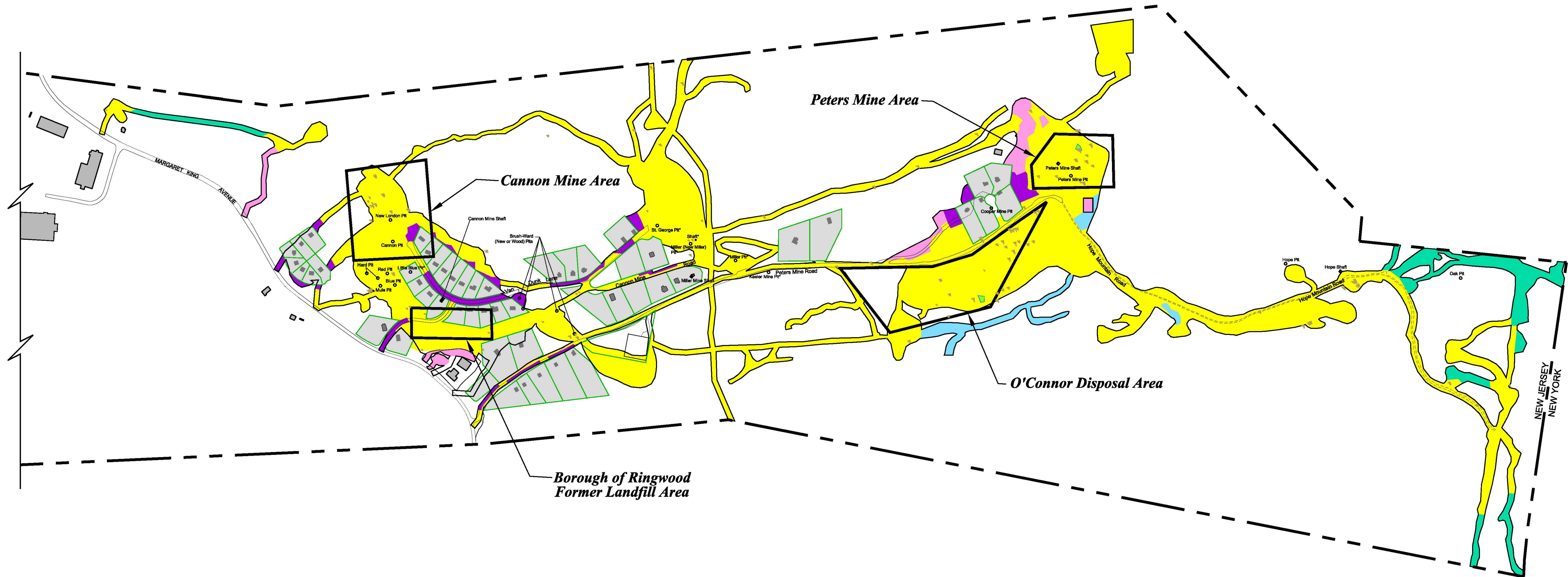
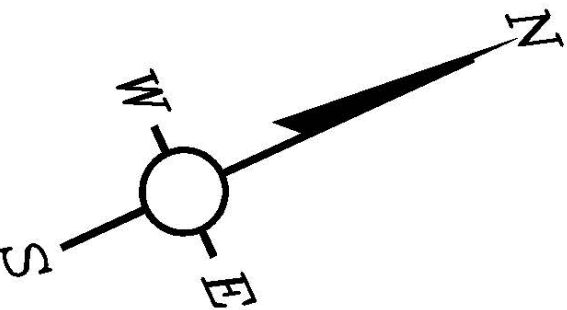


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PROJECT MANAGER E. CARMAN	DEPARTMENT MANAGER C. MOTTA	LEAD DESIGN PROF. J. ROCKLIN	CHECKED BY E. ZIMMERMAN
SHEET TITLE FIELD RECONNAISSANCE SURVEY PAINT SLUDGE NODE LOCATIONS		TASK/PHASE NUMBER 00001	DRAWN BY T. PERRET
PROJECT NUMBER NJ000593.0009		DRAWING NUMBER 5	



LEGEND

- COMPLETED SURVEY AREAS
- CURRENTLY USED BY RESIDENCES (TO BE SURVEYED BY USEPA)
- NOT SURVEYED BECAUSE OF STANDING WATER
- NOT SURVEYED BECAUSE OF PRESENCE OF PERMANENT STRUCTURE
- NOT ACCESSIBLE TO TRUCK TRAFFIC (atv trails, hiking trails, etc.)
- RESIDENTIAL PROPERTIES (TO BE SURVEYED BY USEPA)
- BUILDINGS
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE
- VISUALLY OBSERVED DRUM
- SUBSURFACE DRUM OR DRUM REMNANTS

NOTE:
THROUGH SEPTEMBER 22, 2005, DRUM OR
DRUM REMNANTS HAVE BEEN REMOVED
FROM 90 OF THE 101 LOCATIONS SHOWN
ON THIS MAP.

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DEPARTMENT MANAGER
C. MOTTA

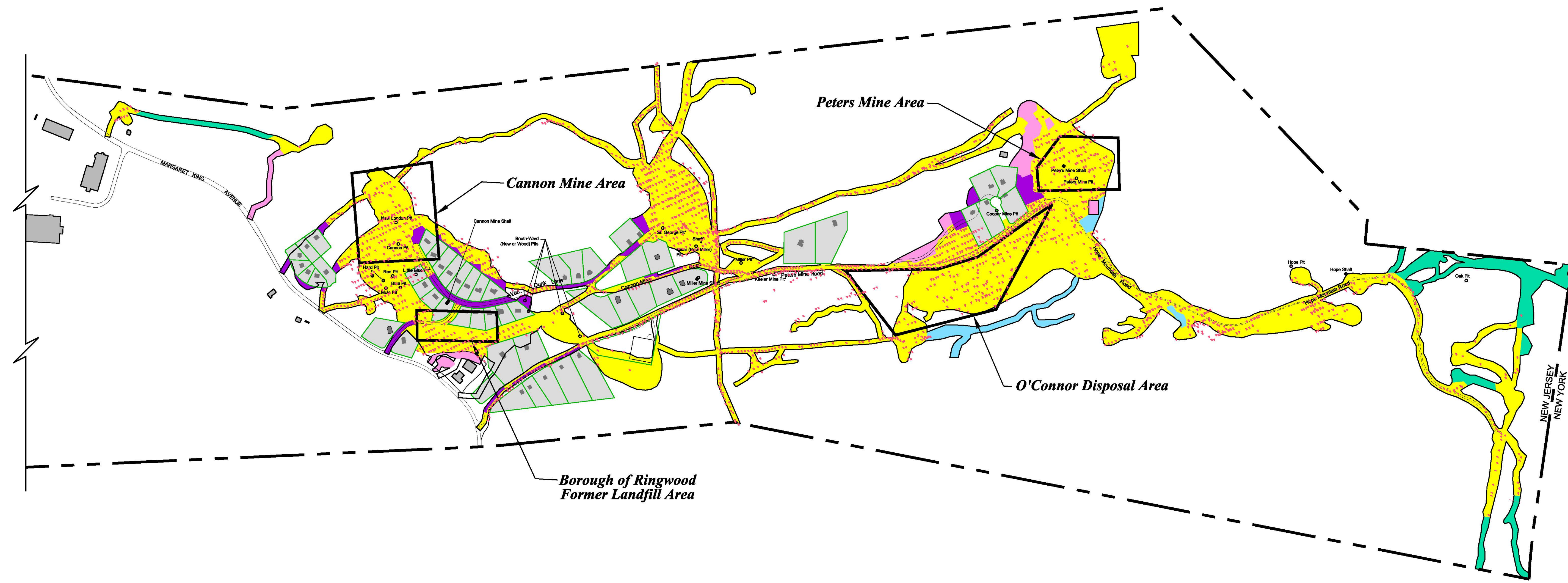
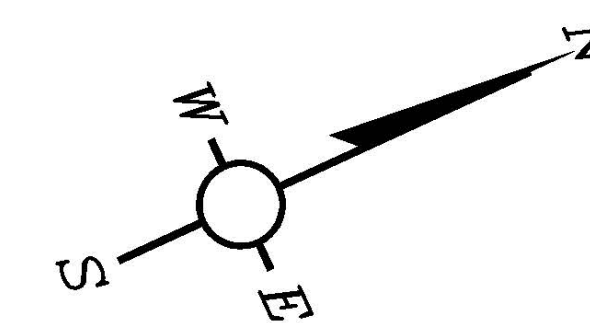
LEAD DESIGN PROF.
J. ROCKLIN

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SHEET TITLE
FIELD RECONNAISSANCE SURVEY
DRUM AND/OR
DRUM REMNANT NODE LOCATIONS

TASK/PHASE NUMBER
00001
PROJECT NUMBER
NJ000593.0009

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DRAWING NUMBER
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LEGEND

- AREAS SURVEYED
- CURRENTLY USED BY RESIDENCES (TO BE SURVEYED BY USEPA)
- NOT SURVEYED BECAUSE OF STANDING WATER
- NOT SURVEYED BECAUSE OF PRESENCE OF PERMANENT STRUCTURE
- NOT ACCESSIBLE TO TRUCK TRAFFIC (atv trails, hiking trails, etc.)
- RESIDENTIAL PROPERTIES (TO BE SURVEYED BY USEPA)
- BUILDINGS
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE
- VISUALLY OBSERVED REFUSE

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PROJECT MANAGER
E. CARMAN

DEPARTMENT MANAGER
C. MOTTA

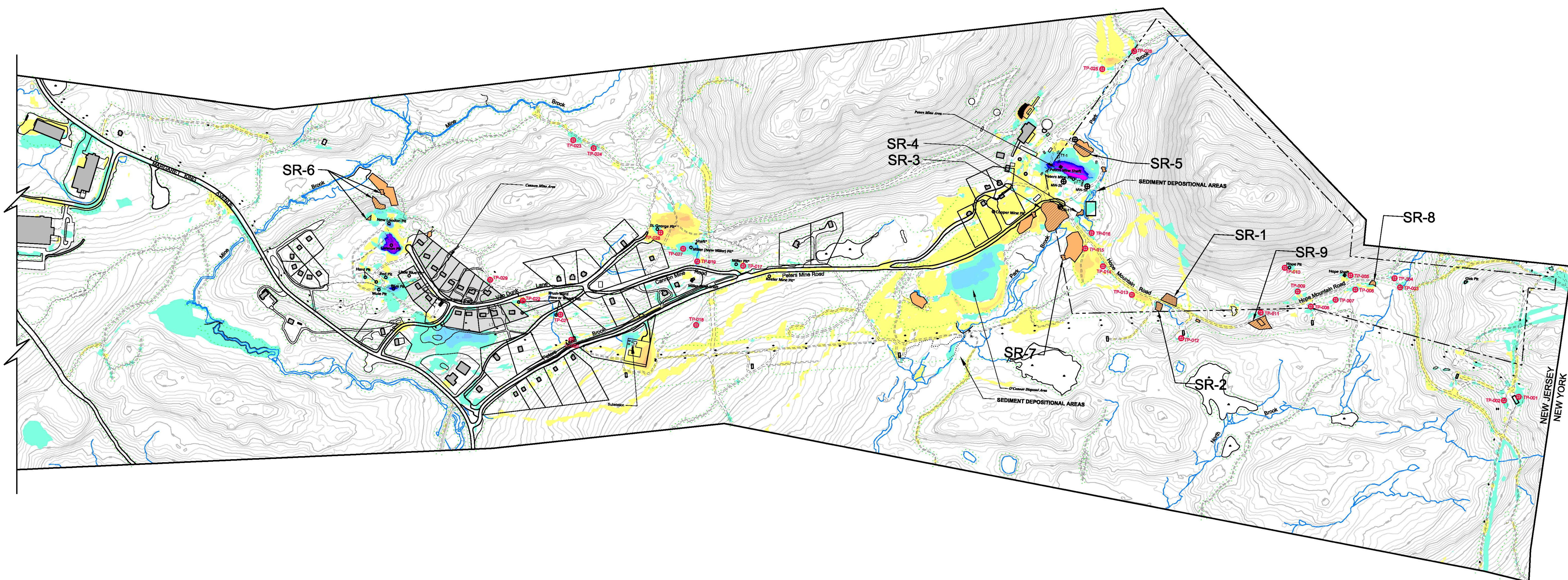
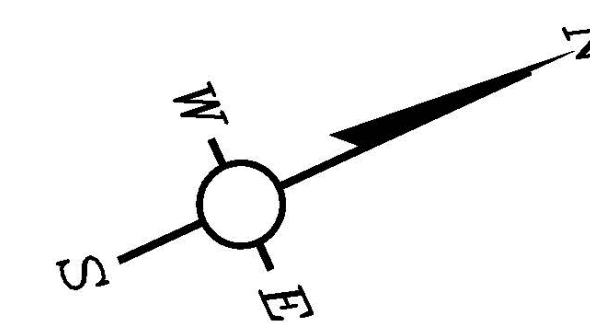
LEAD DESIGN PROF.
J. ROCKLIN

CHECKED BY
E. ZIMMERMAN

SHEET TITLE
FIELD RECONNAISSANCE SURVEY
REFUSE NODE LOCATIONS

TASK/PHASE NUMBER
00001
PROJECT NUMBER
NJ000593.0009

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T. PERRET
DRAWING NUMBER
7



LEGEND

- MW-10 PROPOSED OVERBURDEN AND BEDROCK MONITORING WELL LOCATION
- TP-001 TEST TRENCH
- CB-11 EXISTING MONITORING WELL
- WASTE PROFILE BORING LOCATION
- PROPOSED TESTPIT LOCATION
- CURRENT PAINT SLUDGE REMOVAL AREA (SR-3 THRU SR-9)
- 2004-2005 PAINT SLUDGE REMOVAL AREA COMPLETED TO DATE (SR-1 & SR-2)
- PRE-2004 PAINT SLUDGE REMOVAL AREA
- TREELINE
- TRAILS
- ROADWAYS
- WATERWAYS, BROOKS
- RINGWOOD STATE PARK BOUNDARY
- BUILDINGS
- TRANSMISSION LINE TOWER
- UTILITY POLE
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE

This map shows how the 1974 conditions differ from the 1961 condition. Only changes in elevation of +/- 1.0 feet are displayed.			
Legend			
Color	Range Beg.	Range End	
Black	-50.00	-40.00	Cut-1974 Ground elevations are lower than in 1961.
Dark Gray	-40.00	-30.00	
Light Gray	-30.00	-20.00	
Yellow	-20.00	-10.00	
Orange	-10.00	-1.00	
White	-1.00	1.00	
Light Blue	1.00	10.00	Fill-1974 Ground elevations are higher than in 1961.
Medium Blue	10.00	20.00	
Dark Blue	20.00	30.00	
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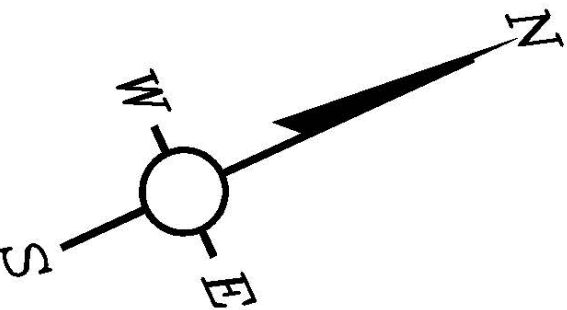


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SHEET TITLE FOLLOW-UP RECONNAISSANCE TEST PIT SURVEY LOCATION		TASK/PHASE NUMBER 00001	DRAWN BY T. PERRET
PROJECT NUMBER NJ000593.0009		DRAWING NUMBER 8	



LEGEND

- 4 IDENTIFIED SURVEY AREAS
- RECONNAISSANCE SURVEY AREAS
- RESIDENTIAL PROPERTIES (TO BE SURVEYED BY USEPA)
- BUILDINGS
- FORMER MINE PIT
- FORMER MINE SHAFT ENTRANCE

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PROJECT TITLE

RINGWOOD MINES/LANDFILL SITE
RINGWOOD, NEW JERSEY

PROJECT MANAGER
E. CARMAN

DEPARTMENT MANAGER
C. MOTTA

LEAD DESIGN PROF.
J. ROCKLIN

CHECKED BY
E. ZIMMERMAN

SHEET TITLE

FIELD RECONNAISSANCE
SURVEY AREAS

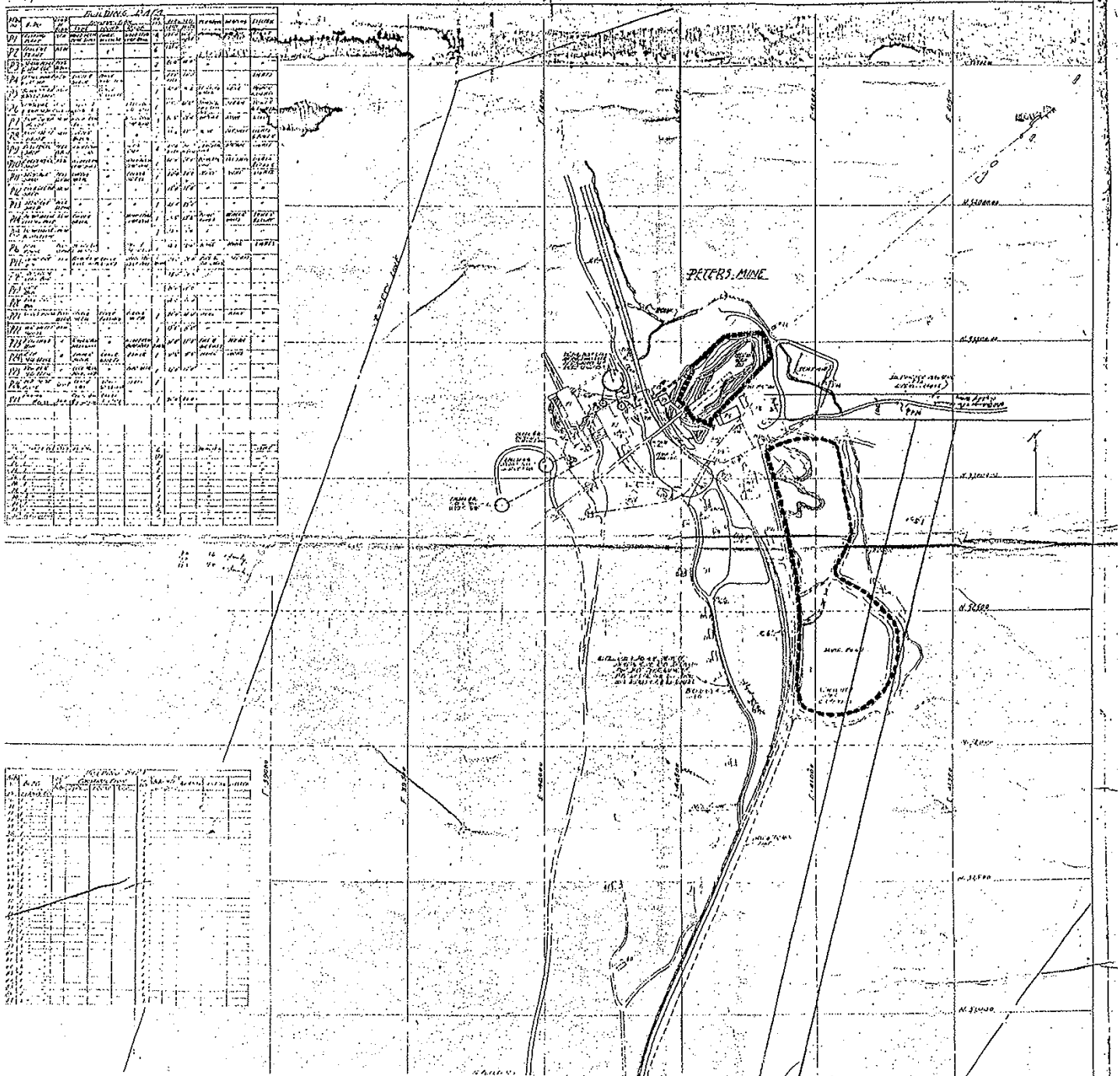
TASK/PHASE NUMBER
00001

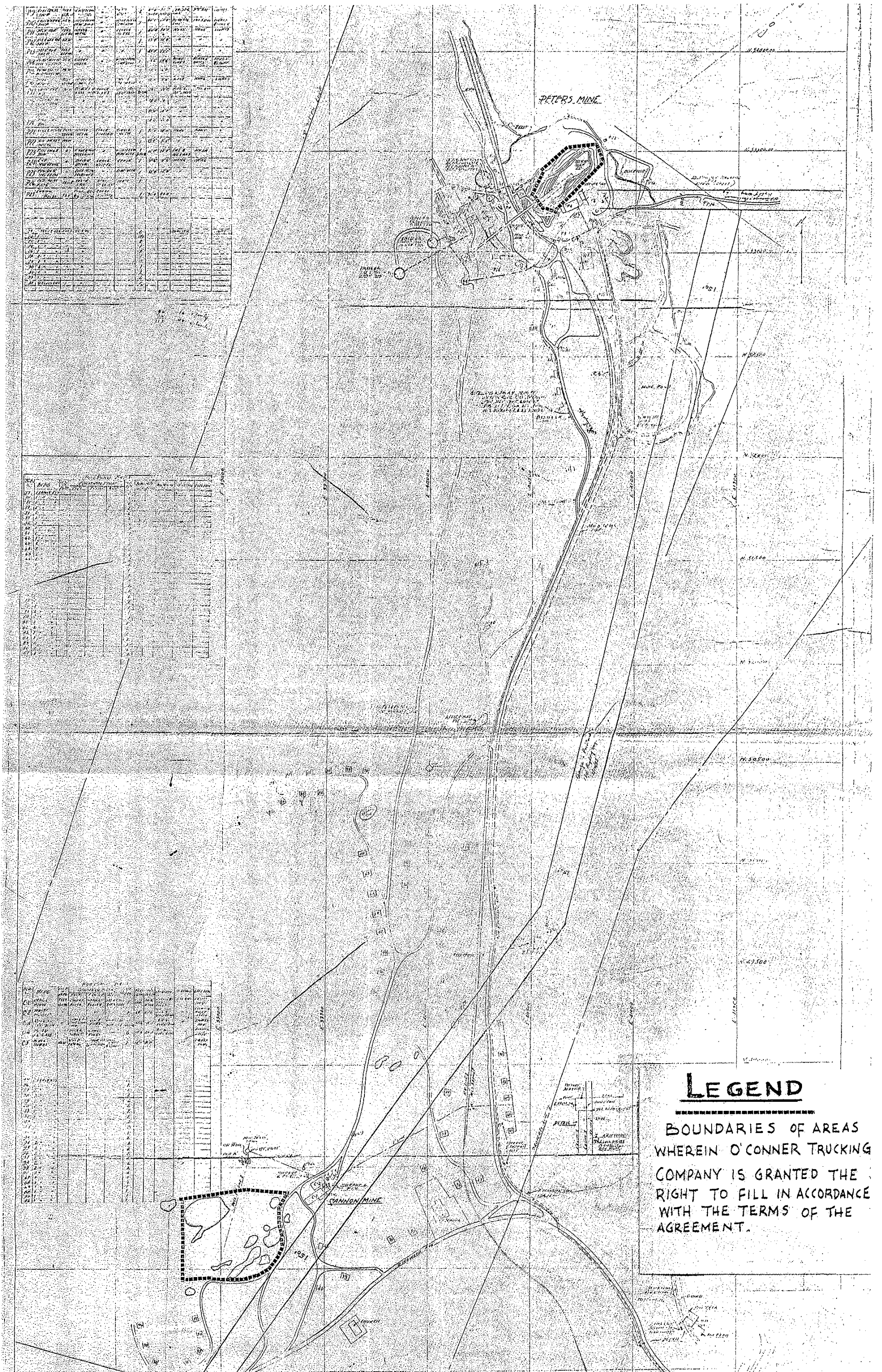
PROJECT NUMBER
NJ000593.0009

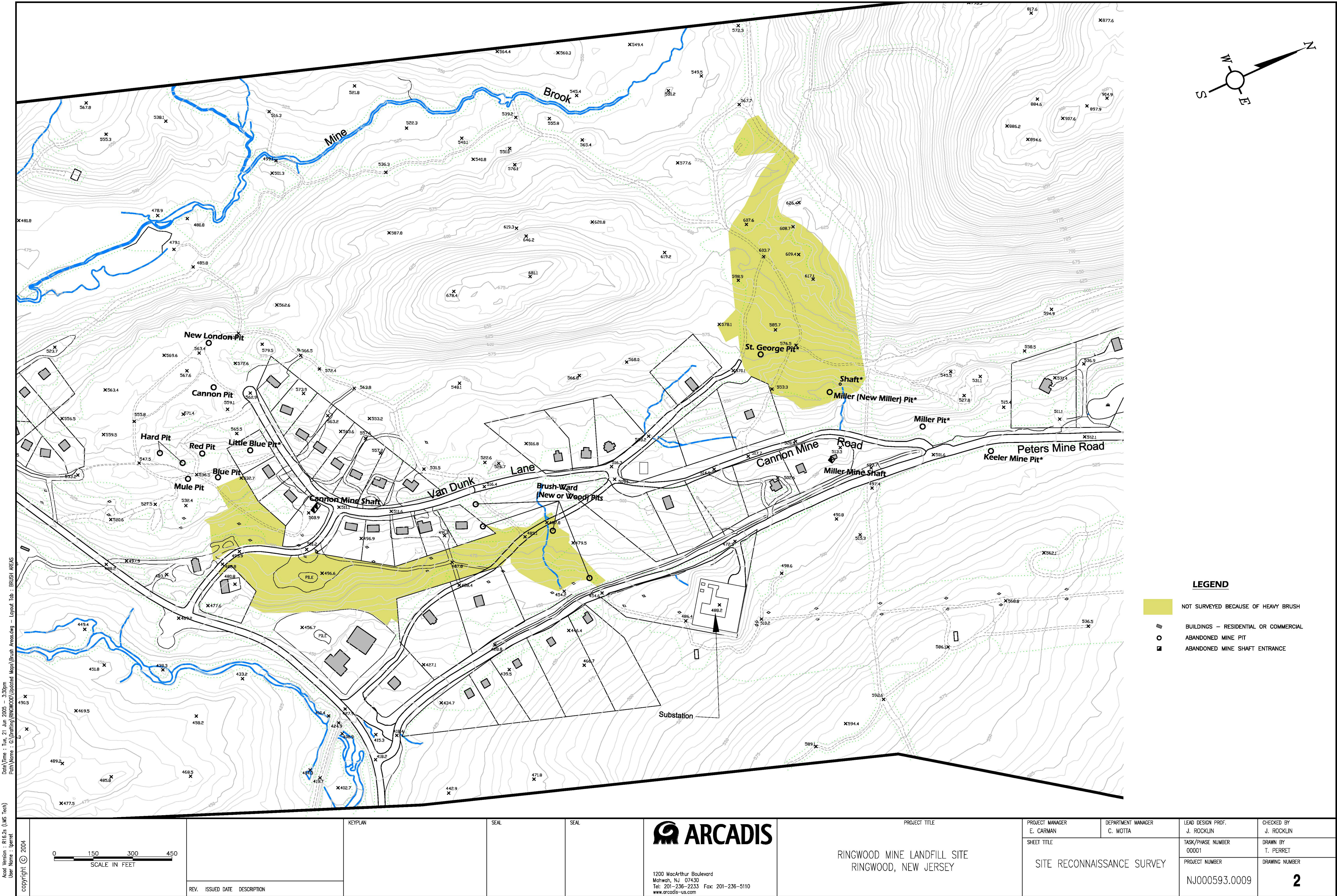
DRAWN BY
T. PERRET

DRAWING NUMBER
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Drawn: 21 Jun 2005 - 3:30pm
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As of Version: R16.2a (LMS Tech)
User Name: jperret

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REV. ISSUED DATE DESCRIPTION

KEYPLAN

SEAL

SEAL



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PROJECT TITLE

RINGWOOD MINE LANDFILL SITE
RINGWOOD, NEW JERSEY

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SHEET TITLE
SITE RECONNAISSANCE SURVEY

TASK/PHASE NUMBER
00001

DRAWN BY
T. PERRET

PROJECT NUMBER
NJ000593.0009

DRAWING NUMBER
2

RINGWOOD SITE UPDATE

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RINGWOOD SITE UPDAT

Appendix C: Photos of Non-Ford Related Refuse



PHOTO 1. Existing refuse visible after brush clearing operations in Area 10B.



PHOTO 2. Large pile of household refuse located within Area 6



PHOTO 3. Pile of tires located downhill of Area 4.



PHOTO 4. Pile of household refuse adjacent to a residential property within Area 10.



PHOTO 5. Refuse (cars, tires, AST/UST, etc.) downhill of Hope Mountain Road between Areas 2 and 4.



PHOTO 6. Two USTs/ASTs located during the field survey of Area 6.

Progress Updates

Third Quarter 2011
First Quarter 2010

First Quarter 2009
Second Quarter
2008

Jan/Feb 2008
2008 Fact Sheet

- What's New
- |
- Ringwood History
- |
- Progress Updates
- |
- Q&A
- |
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- Links
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- Contact Us

6. Technical Data

Tracking Characteristics

- **Satellite Reception**
 - Single frequency
- **Receiver channels**
 - 12 L1 continuous tracking
- **L1 channels**
 - Carrier phase, C/A narrow code
- **L1 Carrier Tracking**
 - Reconstructed carrier phase via C/A code
- **L1 Code Measurements**
 - Carrier phase smoothed C/A code measurements
- **Satellites Tracked**
 - Up to 12 simultaneously on L1

Time to first phase measurement typically 30 seconds.

GPS Antennas

- **AT501**
 - Microstrip L1 antenna with built in groundplane
- **RTB**
 - Combined GPS L1/ beacon antenna
- **RTS**
 - Combined GPS L1/ L-Band antenna

Interface

- **Port 1**
 - Conformable with RS232
 - Lemo 7 Pin
- **BLUETOOTH Specification**
 1. Radio:
 - Taiyo Yuden Class 2 Bluetooth module EYSF2SSXX
 - Nominal transmit 0dBm with included antenna
 - Frequency range from 2402 to 2480 MHz
 - Transmission power < 2.9 mW (e.r.p.)
 - Operating range within 10m
 2. Other Characteristics
 - Baudrate 115.2 kps
- **Baudrate**
 - 300/1200/2400/4800/7200/9600/19200/38400/57600/115200 bps
- **Data Format**
 - Parity none/odd/even
 - Data Bit 7;8
 - Stop Bits 1;2
 - Flow Control RTC/CTS
 - XON/XOFF
- **WoRCS RTB Module RTB01**
 - Beacon Module frequency range ...285.5 to 325.0 KHz
 - Supply Voltage+7.2VDC
 - Nominal Power 0.75 W

Equipment weights

- **Receivers**
 - Leica Geosystems GS20 0.55 kg
 - WoRCS RTB 1.45 kg
 - USB Bluetooth Module 0.1 kg
- **Antennas**
 - AT501 0.4 kg

Power

- **Supply Voltage**
 - All equipment: Nominal 7.2V DC
 - External: 12V DC

Separation distances

- **Leica Geosystems GS20 to AT501 RTB or RTS Antenna**
 - Supplied cables: 1.2m
 - Longer cables available on request.

Baseline precision

The following specifications are based on measurements processed using Leica Geosystems GIS DataPRO software and are given as baseline rms (root mean square).

Differential Phase

Operation	Static	Rapid Static	Kinematic
	10mm + 2ppm	10mm + 2ppm	20mm + 2ppm

Differential Code

Operation	Post Processing	Realtime DGPS
Static	30 cm	40 cm
Kinematic	30 cm	40 cm



Baseline precision is dependent upon various factors including the number of satellites tracked, constellation geometry, observation time, ephemeris accuracy, ionospheric disturbance, multipath and resolved ambiguities.

Environmental Specifications

Product	Operation	Storage
Leica Geosystems GS20 and WoRCS	-20°C to +55°C (-4°F to 131°F)	-40°C to +70°C (-40°F to 158°F)
AT501	-40°C to +75°C (-40°F to 167°F)	-40°C to +75°C (-40°F to 167°F)
Leica Geosystems PC-cards, all sizes	-20°C to +75°C (-4°F to 167°F)	-40°C to +75°C (-40°F to 167°F)
Battery internal	-20°C to +55°C (-4°F to 131°F)	-40°C to +70°C (-40°F to 158°F)

- **Humidity**
 - Up to 99%, non-condensing
- **Weather**
 - Will withstand rain, snow, dust, sand etc.

Conformity to national regulations

- FCC part 15 (applicable in U.S.)
- European directive 1999/5/EC on radio equipment and telecommunications terminal equipment (see CE Conformity Declaration).
- The conformity for countries with other national regulations not covered by FCC part 15 or European directives 1999/5/EC has to be approved prior to use and operation.



Frequency Range 2402 - 2480 MHz
Transmission power limited to < 2.9 mW (e.r.p.)

Antenna
Type: Internal patch antenna
Gain: 2.7 dBi